

Discrete Lyapunov Functional for Cyclic Systems of Differential Equations with Time-Variable or State-Dependent Delay

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Abstract

We consider nonautonomous cyclic systems of delay differential equations (DDEs) with variable delay. Under suitable feedback assumptions, we define an (integer valued) Lyapunov functional related to the number of sign changes of the coordinate functions of solutions. We prove that this functional possesses properties analogous to those established by Mallet-Paret and Sell for the constant delay case and by Krisztin and Arino for the scalar case. This may serve as an effective tool in the study of the global dynamics of DDEs with variable delays. For example, the results can be applied to cyclic systems of DDEs with state-dependent delays to obtain a Morse-decomposition of the global attractor.

This is a joint work with István Balázs (U. Szeged).

References

- [1] I. Balázs, Á. Garab, Discrete Lyapunov functional for cyclic systems of differential equations with time-variable or state-dependent delay, *J. Differential Equations* **452**(2026), 113768.
- [2] I. Balázs, Á. Garab, T. Rauscher, Morse decomposition for semi-dynamical systems with an application to systems of state-dependent delay differential equations, *J. Dynam. Differential Equations*, published online, 2025.